PLASTIC AIRPLANES

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Aerodynamics of plastic planes are unbeatable. They have from 30 to 50 percent less profile drag than a plane of riveted skin construction. A well designed plastic plane requires approximately 25 per cent less power at a given speed than a similar all-metal plane. This surface on one model increased the cruising speed, at the same power, from 95 to 125 mph.

This new material is just an improved plywood. After the experts said that plywood was doomed, the material resided in experimental laboratories until it emerged with new finishes, adhesives, properties, and improved manufacturing methods. From a military standpoint its resistance to gunfire is very important. The material is threatening metal in all but the very large plane field and in structures that are subjected to very high concentrated loads. Yet during World War I the plywood warped, split, pealed, cracked, and drew termites. At that time they used mostly reversible glues that are hard when dry and soft when remoistened. The present plywood has the famous plastics as the bonding materials. With their introduction, the sales of plywood began a prompt increase.

The reason for the new plywood's invasion into the aviation industry lies in the "stressed skin construction" phrase that describes aircraft whose skins carry a high percentage of the loads. A large number of riveted reinforcing stiffeners are necessary to keep metal from buckling; but since plywood has a low specific gravity, it is possible to use plywood skins 4 or 5 times as thick as metal skins without additional weight. These thick plywood skins are very stiff, and due to their elasticity they can be stressed almost to the breaking point without deformation.

Along with plastic bonded plywood other materials were experimented with but none had the desired properties. Solid synthetic resins were found to shatter on impact and to have three times the weight of wood. Wood flour and wood pulp fillers were tried, but they lacked the necessary strength. Only the combination of veneers with orderly arrangement of fibers and the plastics' resistance to moisture and temperature give the perfect combination we have to-day. The wood has a high tensil strength and the plastics have a high bearing strength. This combination forms the "improved wood".

It has been reported that certain German Heinkels are made largely of "improved wood". Fokker has been using wood quite extensively for a long time. Italian manufacturers have found that plywood gives the solution to production in quantities.

American experimenters began playing with plastics from 1933 to 1935. In 1937 and 1938 small companies started producing plastics. Haskelite Manufacturing Company and the Fairchild Engine and Airplane Corporation are given credit for Duramold. The Hughes Aircraft Division of the Hughes Tool Company then became interested in the new material. The Aircraft Research Corporation of Bendix, N. J., developed Gene Vidal's process for making Weldwood. The Timm Aircraft Company developed Aeromold, and later an army trainer encouraged the manufacturer to undertake an Aeromold pursuit ship patterned after Howard Hughes' racer that crossed the continent in 7 hours and 29 minues.

Plastic-bonded plywood is used in most plans for some parts and an increasing number of builders are using it for fuselages. The claims at first glance, seem extravagant. The materials are said to be non-corrosive, non-inflammable, and waterproof.

Plastics-bonded plywood is usually made in flat sheets which are used by plane makers for wing skins and other sheet parts. Even small companies can use ready-made plywood for manufacturing. Many new manufacturing methods have appeared that are as new as the material itself.

The molding process consists roughly of applying heat and pressure to alternate layers of veneer and plastic-impregnated tissue to fuse them into a single unit. After the plastic has been softened and re-solidified some of it will have penetrated the wood fiber enough to fuse the veneer on either side of the plastic. Glues and adhesives that set colder are being tried, as are bonding materials that set with less pressure.

In the Vidal process a wooden male mold of exact inside proportions of the part specified may be employed. After having been dipped in a resin solution and permitted to dry, veneers of the desired flat pattern are hung over the male mold. When the veneer and plastics are on the male mold in wafer style the whole business is inserted into a large rubber bag. The air is removed from the bag which, with its contents, is then put into a large steel tank. In the tank, steam builds up the desired temperature and pressure for the necessary length of time.

The big secret of the third process, Aeromold, is that its plastic does not require a great deal of heat and pressure to be set. This process uses dies and heated presses to stamp out the blank shape before molding the veneer and plastics. After the parts are pressed in precision molds to get the desired contours

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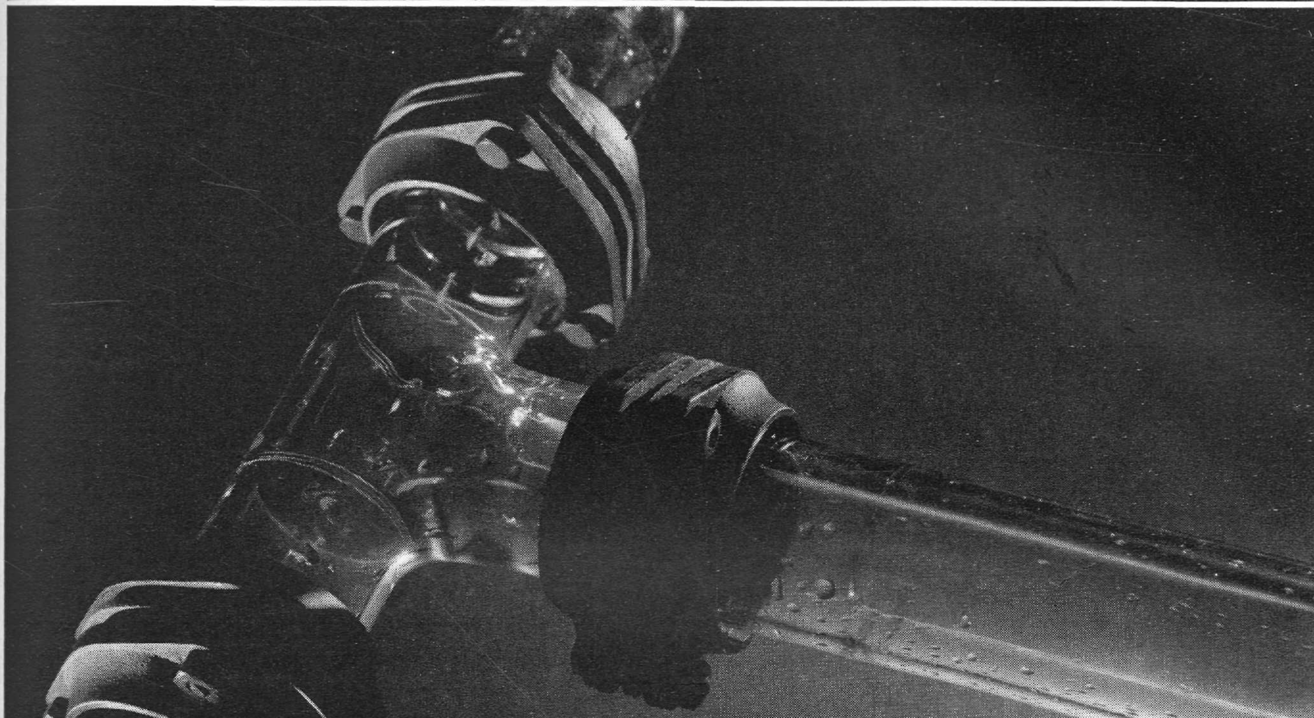
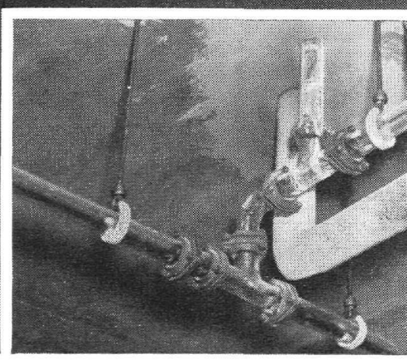
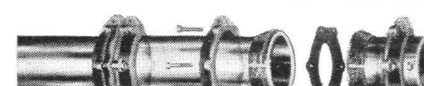
The pipe that can't keep a secret...







LEFT: *PYREX Pipe Lines—from 1" to 4" in diameter—are hung much like other types of piping. This picture shows the use of straight lengths, an "L", and two "T"s".*

ABOVE: *This close-up of 4" PYREX Piping shows the parts used in a joint: metal flanges, asbestos inserts, and a gasket.*

THIS ginger ale maker is as finicky as a New England housewife. (Probably why his ginger ale is an Eastern best-seller.)

"I want pipe I can see through", he said, "so I know it's clean. Pipe that can't alter the flavor of my product any more than the glass bottles it is sold in. Darn it, I want glass pipe!"

Glass pipe lines, made by Corning, are a familiar sight in food, beverage, and chemical plants . . . paper mills, refineries, explosives factories . . . drug, medicine, and cosmetic plants . . . in short, wherever product purity is vital.

Highly resistant to corrosion attack, Corning's PYREX Piping eliminates this cause of contamination. Transparent, it keeps no secrets . . . a glance tells of flow, cleanliness, color, sedimentation. And freedom from pitting and scaling means long life for these pipe lines, with low maintenance costs.

Important? Yes. For in today's urgent program there's no place for impure products, production stoppage, high maintenance costs, or wasted materials. And in many instances, glass has proved it can outperform metals, do an essential job better and at a lower cost.

To the engineer, this glass piping is important as an example of the many-sidedness of glass in industry and of Corning research in glass . . . research that takes in its stride such divergent tasks as the making of a tiny chemical-resistant glass spring, smaller than your thumb, or the casting of the world's largest telescope mirror, a giant one-piece disc 20 tons in weight. Today more than ever Corning is headquarters for research in glass. Industrial Division, Corning Glass Works, Corning, New York.

CORNING

means

Research in Glass

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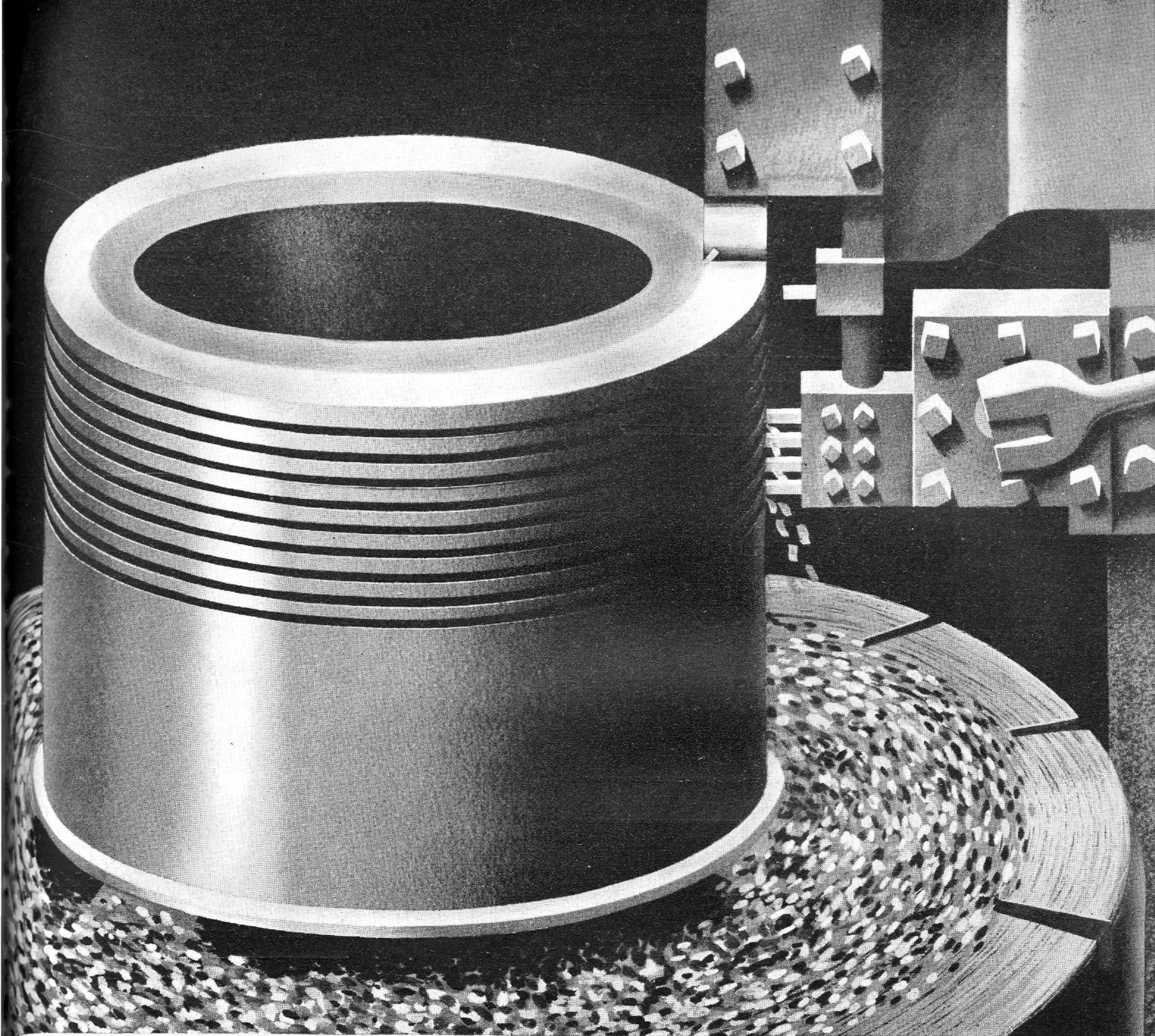
they are baked in a large oven at 100° F. These separate parts are assembled and then baked at 180° F. to fuse the separate elements together. A plastic paint is used to give a smooth finish to the product. This third process is used mostly to make plane fuselages and wings.

This "improvement", with its many advantages, is finding its way from aviation into other fields such as auto fenders and bodys, boat hulls, and pre-fabricated houses. These are a few potential uses of the wood that took wings.



HOW TO SEE RED...AND LIKE IT!

Friction . . . arch enemy of *speed* in the machining of iron and steel . . . meets its match in cutting tools made of Haynes Stellite non-ferrous alloys. For these alloys . . . of cobalt, chromium, and tungsten . . . have the amazing property of "red hardness." Unlike cutting tools made of ordinary metals, they *keep their edge* . . . and keep on cutting . . . even when friction heats them *red hot.*

Making possible tougher, longer-lasting cutting tools is only one of the vital roles played by Haynes Stellite materials. Because they stand up under heat, abrasion, and corrosion, they are used to hard-face many different kinds of metal parts.

Oil well drilling bits . . . steam shovel bucket lips . . . heavy gears . . . shafts . . . airplane and truck exhaust valve seats . . . crusher blades . . . mixers . . . plowshares . . . and other pieces of equipment that must withstand steady punishment have their lives lengthened . . . and their efficiency stepped up . . . with welded-on hard-facings of Haynes Stellite alloys.

Use of Haynes Stellite alloys speeds up production . . . lowers production costs . . . saves on tool and part replacements . . . reduces time lost while replacements are being made. In the fabrication of new parts, base metals can be selected for such valuable properties as strength and ductility—without particular regard for wear-resistance—because they can then be armored against abrasion, heat, and corrosion by hard-facing with Haynes Stellite alloys.

Further savings can be made by the use of these alloys because worn parts can be *renewed*, instead of being sent to the scrap pile . . . thus eliminating replacement with materials hard to obtain.

Faster production . . . conservation of metals . . . lower costs . . . these are the contributions made to industry by Haynes Stellite alloys.

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The development of Haynes Stellite Company alloys and hard-facing practice has been furthered by the metallurgical knowledge of Electro Metallurgical Company, by the research facilities of Union Carbide and Carbon Research Laboratories, Inc., and by the service organization of The Linde Air Products Company—which companies also are Units of Union Carbide and Carbon Corporation.

HAYNES STELLITE COMPANY

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